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Notes on Public Works in India. By COLONEL SYKES, F.R.S., M.P.

[Read before the Statistical Society of London, 19th January, 1858.]

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I.—*Introduction.*

THE subject of Public Works in India is so vast that, for details, I shall limit myself to the Budgets of the last four years received; prefacing them with a few observations upon the present and previously existing modes of managing these important objects.

Previously to the establishment of the present "Department of Public Works," that important branch of administration was variously conducted at the several Presidencies. In Bengal, the system in force for the superintendence and execution of all Public Works, whether Civil or Military, was to give the control to the Military Board. In Madras, there was a threefold management :—

- 1st. The Public Works Department of the Board of Revenue.
- 2nd. The Superintendent of Roads.
- 3rd. The Military Board.

In Bombay, the Military Board was the one controlling authority, though the Superintendent of Roads and Tanks, while subordinate, occupied a position apart from the rest of the system. A complete re-organization of the Department, at all the Presidencies, was resolved upon in 1854, and a separate Department of the State was framed for the consideration of all questions connected with Public Works.

One important feature in the new system, was the introduction of Annual Budgets, under which all projects recommended by the Local Governments are submitted together for the approval of the Supreme Government. Another is the preparation of an Annual Progress Report, prepared from materials furnished by the several Local Governments, and containing an analysis of the circumstances affecting the progress and cost of each work.

II.—Reorganization of Public Works Department.—Directors' Despatch of March, 1852.

The best account that can be given of the reforms which have been made during recent years in the Department of Public Works in India, will be furnished by the following passages from a Despatch by the Court of Directors to Bengal, dated 3rd March, 1852, and written with reference to a Report of the preceding year on the measures of Reorganization required.

The despatch is as follows:—

“1. Pursuant to the instructions given in our letter in the Public Department, dated the 30th January, 1850, a Commission was appointed by you in December of that year, to enquire into the system of superintendence and execution of Public Works in the Presidency of Bengal.

“2. This Commission was composed of the following officers, viz.: Major J. Pitt Kennedy, H.M.S., Consulting Engineer to the Government of India; Major Baker, Bengal Engineers; Mr. Charles Allen, Bengal Civil Service.

“3. Their Report bears date the 5th March, 1851.

“4. After a most careful and elaborate enquiry, the Commission have reported unanimously and decidedly against the continuance of the present system of superintendence of Public Works by the Military Board.

“5. It has long been apparent to us, that the magnitude and multiplicity of the executive and controlling duties confided to the Military Board, were greater than could be properly discharged by that Board. We have, in consequence, cordially approved of the measures which have been taken from time to time, for detaching a member of the Board to attend on the Governor-General when absent from the Presidency, in order that the Governor-General might be enabled to deal promptly with questions which would otherwise have required a reference to the Military Board, involving great and injurious delay. We have also cordially approved of the Governor-General having ordered, on his own responsibility, the execution of Military Buildings and other works in the Punjab, and so avoided the loss of time which the distance of 1,000 miles from the Presidency and the forms of office would have necessarily entailed.

“6. It is now in the last degree important that arrangements should be made for securing the prompt and efficient discharge of the duties devolving on the Department of Public Works, and we view with much satisfaction the report of the Commission, as containing results and proposals which we trust will enable your Government to accomplish this great object.

“7. Without encumbering this despatch with all the details which

have led to the results now before us, we will proceed at once to announce to you our approval of the following measures as proposed by the Commission, and unanimously recommended by the Governor-General, by the Deputy Governor of Bengal, and by the Members of Council.

“8. The Department of Public Works, Civil and Military, to be removed from the superintendence of the Military Board, and placed under the administration of one officer in each of the three great divisions, viz. :—

“1st. The Lower Provinces,

“2nd. The North-Western Provinces,

“3rd. The Punjab, including the territories beyond the Jumna,—to be designated Chief Engineer of those divisions respectively.

“Each Chief Engineer to be in direct communication with the Local Government under which he is placed: that in the Punjab being, for the present, the Board of Administration; and to discharge, under the orders of those authorities respectively, the same functions of check and control, within his division, as are now entrusted to the Military Board.

“Each Local Engineer to be invested with administrative authority over both Civil and Military Works, but, except within certain limits of expense to be hereafter fixed, the power of sanctioning new works to be restricted, as at present, to the Governor-General in Council.

“Each Chief Engineer to be assisted by two or more deputies, designated Superintending Engineers, who shall perform the same duty of supervision of executive officers in their several charges as Superintending Engineers at present perform.

“The territories under each Local Government to be divided into compact and manageable districts, each under an executive officer as at present.

“9. Under these arrangements, the separate office of Chief Engineer, as at present constituted, will become unnecessary, and will be abolished on the next vacancy; leaving for future consideration such arrangements as may be required for the general conduct of business connected with the Engineers as a corps of Officers. The officer now holding the office of Chief Engineer, who will be relieved from the duties of the Military Board, will be available for the important duties of Chief Engineer of one of the new divisions.

“10. We entirely approve of the suggestion, that the establishment of executive Engineers shall be strengthened by the addition of a well qualified Accountant, so as to enable the Engineer to devote his principal attention to the Engineering duties confided to him. It is our intention to cause our Engineer Officers under instruction at the

Royal Engineer establishment, at Chatham, to go through a course of book-keeping, in order the better to qualify them to supervise the accountants in the performance of their duties.

“ 11. We would call your especial attention to the valuable suggestions of the Commission on the subject of contracts for public works, as contained in paragraphs 82-4 of their report.

“ 12. The arrangements now authorized may, as observed by the Governor-General, be expected to produce the following important advantages :—

“ The inconvenience now so sensibly felt from the enormous territory included in the Presidency being superintended by a single departmental authority, at one extremity of it, will disappear.

“ The administrative authority over works both Civil and Military, will, in each local Government, be placed under the guidance of the person or persons best acquainted with the country, its circumstances, and wants; while the same wholesome control over new projects and expenditure, as now exists, will still remain with the supreme Government.

“ The chief departmental authority, in each of the three Governments, will be able to obtain that personal knowledge of the works, and of the districts under his control, which the Military Board could never command.

“ 13. We shall look with much interest for the detailed arrangements which you may propose to adopt, to ensure the energetic and effectual carrying out of the new system.

“ 14. We await the receipt of your matured opinions as to the increased number of Engineer Officers required for the public services. Meanwhile we shall continue to commission as Engineers, from our Military College, all those cadets who have fully qualified themselves for that branch of the service, according to the established test

“ 15. We cannot conclude this despatch without expressing our satisfaction at the manner in which the Commission on Public Works discharged the duty confided to them.”

III.—*Lord Dalhousie's Minute of July, 1854.*

The subject was again revived in 1854, and on the 12th July, in that year, the Governor-General (Lord Dalhousie), forwarded to the Court of Directors a minute, of which the following are extracts :—

“ 8. I have, therefore, now to propose that such an agency shall be provided, by creating an office of ‘Secretary to the Government of India in the Department of Public Works.’* The person

* “ It appears to me,” the Governor-General says, “ however, to be essential to the good working and ready acceptance of this important change, that the officer who will thus be raised, in many respects, virtually above all the rest of his profession, should be not merely a highly qualified Engineer Officer, but the very best man, or,

who holds it should always be a highly qualified Officer of the corps of Engineers. He should have the aid of an Assistant-Secretary, also an Officer of the corps of Engineers. His salary, I think, should not be less than that of the Secretary to the Government of Bengal, viz., rupees 3,000 per mensem; and the salary of the Assistant should not be less than that of the Assistant-Secretaries in the Military Department.

"9. All proposals regarding Public Works, and all communications connected with that department, should be made through the office of this Secretary.

"The whole system will thus at once be reduced to order, and Public Works throughout India will become one great separate branch of internal administration, conducted upon settled principles, and with the advantage of the best scientific and professional advice.

"10. It does not seem necessary that the constitution of the new office should impose anything more than a very slight additional burden upon public finances. If it be resolved to appoint a Secretary and Assistant-Secretary to the Government in the Department of Public Works, the existing offices of Consulting Engineer to the Government in the Railway Department, and Assistant, may be abolished. The only additional expense would then be an inconsiderable increase in the salary of the Secretary beyond that now drawn by the Consulting Engineer."

Of the general tenor of this Minute of Lord Dalhousie's, the Directors approved, subject to some conditions, as indicated in the following extract from their reply :—

"29. We are of opinion that the offices of Secretary and Assistant-Secretary should not be strictly limited to the corps of Engineers. Subject to this exception, we sanction this proposal, with two conditions: 1st. That the Officer in question shall be selected from all the Presidencies, as proposed by Mr. J. P. Grant.* 2nd. That the appointment shall be made for five years only, when it may be renewed at the pleasure of Government; but, if not renewed, it will lapse, as a matter of course, and another Officer will be appointed for a similar period.

"We do not object, to the appointment, in the first instance, of Major Baker.

"30. We concur in the views of the Governor-General respecting at least, one of the very best men available in the Engineer Corps of all three of the Presidencies. An officer to do justice to the place should have practical experience in several lines of the profession; eminent scientific acquirements; a very sound, cool head; all combined with the power of becoming a good office-man. Such officers are rare,—and I think that the scheme will be introduced at a disadvantage if it is accompanied by any incidental provision, on the present occasion, which will have the effect of restricting the field of selection, or lowering the standard of the office."

* Systematic organization of Department of Public Works, 30/1/50.

the desirableness of bringing all the expenditure on Public Works under one head of account in the general books, distinguishing original outlay from charges of maintenance; also distinguishing between expenditure in the nature of investment of capital, and disbursements having no such character. Works of irrigation, and any other works which yield a profitable return belong to a totally different class from works not yielding any return whatever.

"31. In constituting a Department of Public Works it will be necessary to divide the business coming before it into branches. For example, Canals of Irrigation and other Works connected with the Revenue Administration, will belong to the Revenue Branch: Jails to the Judicial: Roads and Bridges to the Public: Churches to the Ecclesiastical. We wish this classification to be observed in your correspondence, and in that of the subordinate Governments, with us. Thus classified, the whole of the Public Works of India will be brought into view in one Department, 'The Department of Public Works;' under which head our despatches relating to them will be in future addressed to the several Governments."

IV.—*Directors' Despatches of May, 1853, and July, 1854.*

The two following letters of May, 1853, and July, 1854, from the Court of Directors, will also show the careful measures which have been taken to place the service of Public Works in India on the soundest bases.

The following are extracts from the Directors' despatch of the 24th May, 1853:—

"4. It is our opinion that the object in view* may best be attained by the adoption of a plan of the following description:—Each of the local Governments should require, annually, from the officers who, in the respective Presidencies, may be vested with the general charge of the roads, a statement of the new works most urgently required for the purposes of intercommunication, and the execution of which, within the ensuing year, he may be prepared to undertake. On receiving this statement it would be the duty of the Government to decide, after a careful consideration of the circumstances of the Presidency at the time, whether the works proposed had been properly selected, in preference to others, for immediate execution; and having come to a conclusion on this point, the whole scheme, involving the proposed expenditure on new roads and bridges for the coming year, should be submitted for your final sanction and approval.

"5. The plan above indicated, though peculiarly required with reference to the means of internal communication, ought also to be applied to Public Works of every description; and believing that

* The application of a larger portion of the Annual Revenue to Public Works, together with part of the Cash Balances.—Despatches 24/5/53, and 7/6/54.

much benefit would arise from the means it would afford of bringing annually under review the wants of each Presidency, as regards buildings, works of irrigation, and other works of a miscellaneous character, we direct that its operations be extended accordingly. It is desirable that, with respect to these works, as in the case of roads, the statements should exhibit the entire expenditure proposed to be incurred on new works, whatever may be the amount of the estimate for each; and we forward to you in the packet, a copy of the Ordnance Estimates as annually laid before Parliament. You will find in that portion of them which relates to Public Works, the Form giving the estimated expense of new works, and the past as well as probable expense of those in progress; and we should recommend that this form should be adopted, so far as it is applicable to the circumstances, in India.

"6. We wish it to be distinctly understood that in issuing these orders it is far from our desire either to place any further restriction on the amount heretofore expended on works of public improvement, or to deprive the Governments of Fort St. George and Bombay of any of the power they have hitherto possessed of authorizing expenditure on such works. Our object is, primarily to secure the application of the money to be expended, in such a way as to produce the greatest possible benefit to the country and to the community; but the proposed plan, while preserving to your Government that general control over the finances of India, which it is intended that you should possess, will have the advantage of relieving your Government from that unnecessary distraction of attention and waste of time which arise from a number of separate projects, relating to objects of a kindred nature, being brought under your consideration at different periods."

And the following are extracts from the Directors' letter of the 5th July, 1854:—

"5. In accordance with these sentiments, it is our intention that the several subordinate Governments should, without loss of time, review the wants of their respective Presidencies, in respect to Public Works, and submit to you, with as little delay as possible, plans and estimates for such as they may consider to be of the greatest urgency and importance.

"6. In order to avoid any unnecessary loss of time, we shall send to the Governments of the minor Presidencies copies of as much of this despatch as is necessary for this purpose, and direct them to send to you their proposals for Public Works, with the necessary plans and estimates.

"7. On receipt of the plans and estimates, which should be framed in the mode pointed out in our despatch of the 24th May, 1853, and which, without being, in the first instance, framed in great detail, should convey such a general idea of each work as will enable your

Government to form a general estimate of the value and importance of each work, as well as of its probable cost, you will proceed to make a comparison of the various proposals, and will decide on those which should be undertaken in each Presidency, due weight being, of course, given to the opinions of the local Governments as to the particular works which they recommend. It is our desire that special consideration be given to the works of the Madras and Bombay Presidencies, in which, from different causes, the execution of works of improvement has not been proportionate with that in other parts of India, and in which, on the other hand, there is full scope for a largely increased expenditure, and every prospect of a fair return for the outlay, especially in works for improving the irrigation of the country.

"8. You will report to us, with as little delay as possible, your decision on these points; and we particularly desire that a full report may be made to us as to the means of providing adequate superintendence, so as to insure the proper execution of such works as you may recommend, and you will forward to us the plans, maps, and estimates of the several works recommended by the local Governments, together with your proceedings on them, for our final approval."

Such were the elaborate and detailed orders of the Court of Directors to insure efficiency. I shall now proceed to results; but as the subject of Public Works is so vast, I must confine my notices to the details of the most important labours, the Ganges and other Canals, Irrigation Works, and Roads; but an inspection of the several Tables will show that there has not been any stint or want of encouragement on the part of the Honourable Court with respect to all branches whatever, that could advantage the public interests.

The tables of the four years' estimates comprise an outlay of more than 10 Millions Sterling, averaging $2\frac{1}{2}$ Millions Per Annum; and it may truly be said that, but for this outlay for a prospective but certain good, there would have been an annual surplus over expenditure in the revenues of India; and the misrepresentations, now designedly made, of mismanagement of the Indian finances would have been deprived of a semblance of truth.

V.—*Roads.*

In the years 1853-4 and 1854-5 the largest items of Expenditure were for Roads and Bridges, and Irrigation Works.

The most noticeable of the Roads were:—

The Dacca and Arracan Military Road:—total length, 327 miles. Bridging Rivers on the Grand Trunk Road in South Behar and Shahabad.

The Branch Road from the Grand Trunk to Patna, *via* Gya.

New Branch of Calcutta Canal.

New Bridge over Tolly's Nulla, at Allipoor. And

The Continuation of the Grand Trunk Road from Calcutta to Peshawar.

The Punjab Section of this last-mentioned road is the principal undertaking now in hand by the Public Works Department in that province. It extends from Kurnaul to Peshawar, and is about 511 miles in length. Of this, nearly 400 miles were open at the close of the official year 1855-6; and the expenditure up to that period had been 860,000*l.* On the subject of roads in the Punjab, it would appear, from the Reports for 1854-55 and 1855-56, that, up to May, 1854, 3,600 miles of roadway had been made in Punjab Proper at a cost of 470,000*l.*; and, in the Cis and Trans-Sutlej States, 1,629 miles at a cost of 75,000*l.*: the aggregate, therefore, was 5,229 miles, and the cost 545,000*l.*

In addition to the Trunk Road before referred to, great progress had been made in many others, while some were in contemplation. In Hazara, and in the Peshawar Valley, 187 miles were completed: in the Kohat District, three valuable Military roads were in progress: whilst numerous others had been roughly made in the Trans-Indus and other districts. On the whole, not less than 3,520 miles of road had been constructed by the Department of Public Works during these two years, which, with the 5,229 miles previously made, make up the large aggregate of 8,749 miles.

The grand trunk road from Calcutta to Delhi, as good as any English turnpike road, is 837 miles long, and cost 489,100*l.* The great Deccan Road from Mirzapoore to Nagpoore is 400 miles long. The Bombay and Agra Road is 735 miles long. Systematic road making commenced in Madras in 1845, and is making great progress.

VI.—*Navigation of Indian Rivers.*

The navigation of the Ganges and the Indus has, to a certain extent, been provided for by Government. Four Government steamers* and four flat-bottomed boats ply on the former, and ten steamers and ten flats on the latter.

In addition to this direct provision of accommodation, the East India Company have lately acceded to proposals for assistance to two schemes for increasing the river navigation in India, viz., a proposition submitted by the Sind Railway Company to run steamers between Kotree, the terminus of the Sind Railway, and Moultan,

* There are also two Companies who run boats from Calcutta, not receiving Government assistance, viz., "The Inland General Steam Navigation Company," for the navigation of the Hooghly and Soonderbunds, and "The Ganges Steam Navigation Company," for the navigation of the Ganges between Calcutta and Allahabad.

the terminus of the Punjab Railway ; and one submitted by the Oriental Inland Steam Navigation Company to open up the navigation of Indian Rivers generally by means of "steam-trains."

The aid promised to the scheme submitted by the Sind Railway Company is a guarantee of interest at the rate of 5 per cent. per annum on capital to the extent of 250,000*l.*, the amount which it is estimated will be required for the undertaking. It is intended to place fifteen steamers on the river ; five to be ready for use within two years from the present date, and five more in each of the two succeeding years. The steamers will be worked in connexion with the railway, and will thus be the means of completing a continuous line of communication between Kurrachee and Lahore and Umritser under one uniform system of management.

The Oriental Inland Steam Navigation Company propose to commence operations on the Indus and Sutlej, by placing on these rivers two "trains" yearly for a period of ten years. Such train is to be capable of carrying, on a light draught of water, either a very large quantity of merchandize, or 1,000 men. The assistance which the Court have promised to this undertaking is a subvention of 5,000*l.* per annum for ten years, the Company agreeing to perform a minimum distance of 20,000 miles yearly. Should the Navigation Company, however, fail to accomplish this distance, or to put on the number of trains stipulated for (the first two trains to be placed on the river within two years from the present date), the agreement, as to the subvention, is to cease and determine, unless the failure, on the part of the Navigation Company, should occur from any cause beyond their control, such, for instance, as the loss of the trains, or any part thereof, by shipwreck while on the voyage to India. The Navigation Company, in return for the subvention, agree to reserve for the East India Company freight to the extent of the value thereof, calculated at the rates now charged by Government on the Ganges boats.

Since the above arrangement was made, the Navigation Company have applied for a modification of the terms of subvention, which is now under the consideration of the authorities.

VII.—*Canals generally.*

The Canals in the North-Western Provinces are—

- 1st. The Delhi Canals, or Western Jumna.
- 2nd. The Doab Canal, or Eastern Jumna.
- 3rd. The Ganges Canal.

The main source of revenue from the Canals west of the Jumna is the water-rent. This, for the year 1846-7, amounted to 26,253*l.* It is computed that, in the year of the great famine, 1837-38, the gross value of crops grown on land irrigated from these Canals, the greater

part of which land would otherwise have been totally unproductive, amounting to 1,462,800*l.*, a sum far exceeding the entire cost of the works.

The next important item of Canal Revenue is mill-rent, which, in 1846-47, amounted to 1,471*l.* Another, though insignificant, source of Revenue is that for Watering Cattle: this, in 1846-47, was 168*l.* This charge is made only to those who pay revenue less than 10*l.* per annum. The other sources are the transit duties, the sale of wood, grass, and fines.*

The following Statement shows the gross revenue for nine years ending 1845-46:—

(A.) *DELHI CANAL, or Western Jumna, 1837-38 to 1845-6, and 1846-7 to 1854-5.*

Year.	Water Rent.	Mill Rent.	Watering Cattle.	Transit Duties.	Sale of Wood and Grass.	Fines for Breach of Regulations.	TOTAL.
1837-38	27,237	578	76	604	522	948	29,966
1838-39	18,964	973	183	822	617	578	22,140
1839-40	22,438	1,456	228	657	482	618	25,882
1840-41	25,581	952	195	973	548	607	28,858
1841-42	26,306	820	155	1,150	560	463	29,457
1842-43	27,930	988	117	793	675	621	31,126
1843-44	26,055	1,259	168	557	482	576	29,099
1844-45	23,102	822	297	659	515	634	26,031
1845-46	26,069	1,325	229	783	705	775	29,887

<i>£</i>	<i>£</i>
1846-47	30,288 Total
1847-48	29,068 ,,
1848-49	30,959 ,,
1849-50	31,472 ,,
1850-51	30,525 ,,

The Delhi Canal, and its branches in the west of the Jumna, originally constructed in the fourteenth and seventeenth centuries, extends to a distance of 425 miles: they had fallen into disuse and consequent decay before the British occupation. Their re-opening has cost 314,380*l.* up to the 1st May, 1844; and the water-rent they have yielded amounts to 334,380*l.*

* *Abstract showing the supposed Value of the Canals West of Jumna as a Property, (1851).*

Land occupied by the Canal Banks and Channel.....	<i>£</i> 23,402
Public Buildings.....	58,492
Standing Trees	55,527
Cost of Excavation.....	46,179

Total Value of the Canals 183,601

The entire length of the Delhi and Western Jumna Canals is 445 miles, and cost 113,797*l.*; and the net revenue, after deducting for the Canal and Civil Departments, shows the amount of interest on the invested capital to be 36 per cent.

2nd. There are the same sources of revenue on the *Eastern* as on the Western Jumna. The influence of the famine year is as marked on this as on the other Canals, the gross value of the crops on land which would otherwise have been unproductive being 491,050*l.* The united Jumna Canals, therefore, saved during the year 1837-38 property to the value of nearly 2 millions sterling.

Nearly half the area irrigated by the Canal has come under its influence since the settlement of the Land Revenue, so that the effect of canal irrigation upon the income of Government can be easily proved. The annual increase due to the canal in the three Districts of Sahrupore, Moozuffernuggur, and Meerut is 15,275*l.* If to this sum the annual direct revenue of the canal is added, 10,998*l.* (in 1845-46), the total return will show 26,274*l.**

The following is the direct revenue from this canal for the period of nine years:—

(B.) DOAB CANAL, or Eastern Jumna, 1837-8 to 1845-6, and 1846-7 to 1854-5.

Year.	Water Rent.	Mill Rent.	Watering Cattle.	Transit Duties.	Sale of Plantation.	Fines.	TOTAL.
	£	£	£	£	£	£	£
1837-38	9,131	500	19	26	122	284	10,083
1838-39	7,301	435	10	42	107	296	8,194
1839-40	7,854	428	6	56	128	381	8,855
1840-41	8,913	329	9	...	247	432	9,932
1841-42	7,888	373	15	96	164	378	8,916
1842-43	10,506	619	3	52	194	368	11,743
1843-44	8,614	817	13	35	141	453	10,076
1844-45	8,478	604	21	28	170	573	9,877
1845-46	9,653	812	10	41	172	308	10,998

£	£
1846-47 12,175 Total	1851-52 16,685 Total
1847-48 12,540 ,,	1852-53 15,140 ,,
1848-49 16,324 ,,	1853-54 16,132 ,,
1849-50 14,950 ,,	1854-55 9,588 ,,
1850-51 14,283 ,,	

* Abstract showing the supposed Value of the Eastern Jumna Canal as a Property (1851).

Value of Public Buildings, &c.	88,374
" Land ,,	294
" Plantations ,,	17,143
Total value of the Canal	106,082

The Doab Canal, on the east of the Jumna, appeared, when the country came into British possession, to have been long entirely abandoned. This canal runs a distance of 130 miles, and was re-opened at a cost of 169,842*l.* The return from water-rent is stated at 92,380*l.*

The length of the Doab and Eastern Canal is 142 miles, and the original cost 80,198*l.* The net annual return on the capital laid out is nearly 24 per cent. Since these works first occupied the attention of the British authorities, they have expended upon them a sum of 557,000*l.*, and have received from them, in direct canal revenue, nearly 546,000*l.* They have brought under the influence of irrigation an area of 1,300,000 acres, yielding produce to the annual value of not less than 2½ millions sterling, and supported a population of 600,000 souls.

VIII.—*The Ganges Canal.*

The Ganges Canal is in progress of execution; and the advantages, in point of revenue, can only be estimated by the results of the other canals. The districts to which the influence of this canal will extend embrace an area of 8,255,255 cultivated acres, and 2,846,793 cultivable acres, or, together, 11,102,048 acres. The total area for which irrigation will be provided is estimated to amount to 5,400,000 acres.

The direct anticipated pecuniary returns from the canal may be estimated at 163,850*l.**

The indirect return from increase of land revenue from the analogous cases of existing canals may be taken at 240,633*l.*, making the total pecuniary return, say, 404,483*l.*; or, allowing for annual repairs, a net revenue of 350,000*l.*, which, calculated upon an estimated original expenditure of 1,250,000*l.*, will show a return of 28 per cent.

The following details will more fully exhibit the real nature of this great work.

The total length of channel navigable throughout the Ganges Canal, including the Trunk and Terminal lines, with the great branches, is very nearly 890 Miles, along which are distributed 17 dams or escapes, with waterways varying from 800 to 18 feet; 202 bridges for the purpose of regulation and cross-communication, with waterways varying from 200 to 20 feet; 297 inlets for local or minor

* *Ganges Canal Estimated.*

	£
Water Rent.....	147,150
Mill do.	10,000
Transit Duties.....	6,000
Sundries	700
	<hr/>
	163,850

drainage; 16 falls for regulating the slopes; 31 locks and navigable channels for navigation; 282 Rajbuha heads for irrigation; an aggregate length of probably not less than 10 miles of bathing Ghats for the use of the community; 49 first class, and 122 second class Chokis for the shelter of the establishments; 6 workshops for supplying the various wants of the canal works; and, lastly, the great aqueduct across the Solani River, unequalled in its dimensions by any work of the kind yet executed throughout the world. It is only necessary to add here that, up to the opening of the canal, Government had expended on the works, south of Roorkee, a sum amounting to about 650,000*l.*

Such is the extent of the work which has been executed on the Ganges Canal, virtually within the last eight years, though it must be remarked that the visible results are far from being a true measure of the amount of labour which has been expended in that time. It is the work of the hand in construction only that is seen on the surface of the country. To estimate the extent of mental and manual labour of other kinds that are required for pure constructive purposes, the records of the office must be examined, and there will be found proofs of the thoughtful care and immense toil with which every part of the great design has been elaborated by those concerned in working it out. Nor should those who execute works of civil engineering in countries overflowing with every resource that mechanical skill and individual enterprise can supply, overlook those peculiar difficulties which beset the engineer's path in India, where his resources are chiefly in himself, and where he must not only be the designer of works, but the head mason, the head carpenter, the head brick and lime burner, in fact, the man of all detail work, or of all general design.

The last point to which it was proposed to advert, in this general sketch, is the nature and extent of the results which are to be anticipated from the execution of the Ganges Canal.

These results arrange themselves into the two following great classes:—

1. Results to the people,
2. Results to the Government.

And it will be convenient to refer to them briefly in their order.

The results to the people may be exhibited under the following heads:—

1. Certain in place of precarious irrigation, in localities where water was before to be had. On this no special remark is called for, as its value is self-evident, though statistics are not at command to admit of this value being stated numerically.

2. Cheaper irrigation from the canal than by any other method now practised. This arises from the smaller amount of animal or

human labour required in using surface irrigation by naturally flowing water than where any mechanical means are used. Well irrigation, at its cheapest, is not less than four times as expensive as canal irrigation, so that, for every Beega watered from the latter, the zemindar will find his expenses, on the item of irrigation, diminished by three-fourths, and the surplus capital in labour or money thus placed at his disposal, can be employed in adding new fields to the cultivated portion of his Rukba.

3. Irrigation, at a moderate cost, in localities where irrigation at all was formerly impossible. The advantage to the zemindar here is almost purely clear gain, and tracts, desert from entire want of water, will, when the canal lines are completed, be irrigable with perfect ease.

4. Increase of produce from land fully and constantly accessible to irrigation over much larger areas than before. This increase is very considerable, and probably would not be over-estimated at a fourth of the returns from the land.

5. Facilities for the production of crops of the more valuable kinds, which cannot be cultivated at all without a certain and abundant supply of water. The effect of increased production and diminished cost thus shown would be to give the whole community cheaper food, and enable it to expend the surplus for other purposes or wants.

6. Increased value to property in land arising from the advantages secured by the presence of the canal.

7. Increase of commercial facilities by the creation of numerous lines of easy and economical transit connected with the great rivers of the Doab.

8. The price to be paid by the people for these advantages is a very moderate water-rent amounting, on the average, to not more than 10 annas per Beega, with a capital expended on the construction of Rajbahas and watercourses, the interest on which, added to the expense of repairing the works, would raise the total charge for irrigation to about 1 rupee per Beega, which would represent the entire outlay of the zemindars. The Mahajuns, or others, using the canal for transit, would pay a transit-duty, purposely fixed much lower than by any other existing means of carriage.

It is hoped that no counteracting disadvantages will arise to mar these promises; and every means that can be thought of will be taken to prevent injury to the land or its inhabitants from the presence of the canal.

The results to Government need be only very briefly adverted to. They are of two kinds: first, direct; and 2nd, indirect or contingent.

The direct results will arise from three main sources:—

1st. The water-rent of 6,750 pymanahs of water, at about an

average of 12*l.* per pymanah. It will be a long time before the full returns can be looked for from this source, as the supply cannot be raised to its maximum till the works are all thoroughly consolidated and prepared for its distribution. But when this time does arrive, the water-rent will give Government an annual return of about 128,250*l.*

2. Transit duties, which may be estimated at about 10,000*l.* per annum.

3. Various miscellaneous items of revenue, which may reach 5,000*l.* per annum.

Hence the gross direct return to the State may be expected to reach ultimately about 145,000*l.* a-year. The annual charge for the maintenance of the work will not fall short of 40,000*l.*; and, considering the time that will elapse before the canal pays its own expenses, with the various contingent works which must be expected to follow, as experience increases, it may be held that the total capital sunk in making the canal, from the period of its commencement to the time when its full returns will be obtained, cannot fall much short of 1,500,000*l.*

A net income of 105,000*l.* on 1,500,000*l.* of capital would be just 7 per cent., and much more than this the direct return can scarcely be expected to prove.

The contingent or indirect returns to Government are mainly derived—

1. From the security against the formidable money payments and remissions required to alleviate famines. What these may be valued at it is difficult to say, but the experience of the famine of 1837-38 proves that it would have been economy to have prevented its occurrence by the total sacrifice of fully two-thirds of the entire capital sunk in the construction of the Ganges Canal; for, if such an act could possibly have prevented it, or greatly alleviated its fatal effects, Government would have been the gainer by the presence of an active cultivating population, which was depressed for years afterwards in the actual state of things. That such prevention or alleviation will be secured by the Ganges Canal admits of no reasonable question.

2. From the increase of land revenue consequent on the extension of the area of irrigation. This may be expected to double the direct returns from the canal itself; and about 14 per cent. on the capital is probably the maximum return to be anticipated as the final result of the execution of the canal.

Such are the chief features of the most remarkable works, for the purposes of irrigation, in the world, as pourtrayed in the official reports of Colonel Sir Proby Cautley, K.C.B., the projector and finisher of the trunk line of the canal, and in the reports of the

present Engineer and Superintendent of the Canal, Lieut.-Colonel Baird Smith.

IX.—*Expenditure on Public Works in 1854-55.*

In the Tables I, II, and III, will be found a tabular synopsis of the whole of the expenditure on Public Works by the different Governments of India for the year 1854-55, so far as the Reports sent in have afforded material, and a succession of Tables showing, in a more detailed classification, the objects upon which this expenditure has been incurred.

A few remarks remain to be made upon the facts which these Tables convey.

The whole amount of expenditure, as it stands, is 223 lakhs of rupees, or say 2,230,000*l.*

Of this, 565,000*l.*, or a little more than 25 per cent., is expended on Military Works.

These last are "Public Works" in quite a different sense from that in which roads and canals or harbours are Public Works, and it is as well to keep the distinction marked.

Other buildings also of a Civil character may be considered merely for the convenience of the Administration, and the collection of the revenues.

But still it is gratifying to find that, if we take merely the items included under the heads of "Public" (the great bulk consisting of roads) and of "Irrigation," the sum amounts to upwards of 1,500,000*l.*, or nearly 70 per cent. of the whole expenditure.

The following is the first Table:—

[June,

TABLE I.
Synopsis of Expenditure on PUBLIC WORKS in INDIA, as Classified under the

CLASSIFICATION.	Govern- ment of India.	PRESIDENCY OF BENGAL.		Punjab.	Madras.
		Lower Provinces.	North- Western Provinces.		
1, 2, 3. <i>Public.</i> —(Roads, Navigable Canals, Post Offices, Hospitals, Government Offices)	7,970	75,805	15,461	339,587	281,987
<i>Repairs</i> .....	....	36,340	8,368	633	34,420
4. <i>Judicial.</i> —(Courts, Police Stations, Gaols, &c.) .....	....	10,376	1,142	1,150	2,794
<i>Repairs</i> .....	....	2,047	61	....	1,500
5. <i>Ecclesiastical.</i> —(Churches, Burying Grounds, &c.) .....	....	547	247	3,032	524
<i>Repairs</i> .....	....	1,093	50	....	....
6. <i>Educational.</i> —(Colleges and Schools)....	....	242	2,581	....	68
<i>Repairs</i> .....	....	263	16	....	....
7. <i>Revenue, General.</i> —(Offices, Opium, Salt, Customs, Tolls, &c.) .....	....	8,756	3,466	1,396	2,821
<i>Repairs</i> .....	....	2,815	89	....	1,000
8. <i>Revenue, Irrigation.</i> —(Canals, Tanks, Embankments, Drainage, &c.) .....	....	488	88,307	135,560	104,572
<i>Repairs</i> .....	....	42,380	18,938	3,441	120,000
9. <i>Marine.</i> —(Docks, Harbours, Light Houses, &c.).....	....	1,958	....	....	6,541
<i>Repairs</i> .....	....	...	....	....	1,000
10. <i>Railway.</i> —(Land Purchase, Govern- ment Control, &c.) .....	....	20,352	....	....	7,041
Total Original Civil Works	7,970	118,526	111,206	480,726	406,351
<i>Repairs</i> .....	....	84,941	27,525	4,074	157,920
<i>Grand Total, Civil Works</i>	7,970	203,467	138,731	484,801	564,272
11. <i>Military.</i> —(Forts, Magazines, Barracks, Cantonments, &c.).....	....	17,852	17,331	257,830	36,141
<i>Repairs</i> .....	....	9,497	3,588	33,081	10,000
<i>Total Military Works</i>.....	....	27,350	20,920	290,911	46,141
Total Civil and Military Original Works	7,970	136,379	128,537	738,557	442,493
<i>Total Repairs</i> ....	....	94,438	31,114	37,155	167,920
GRAND TOTAL OF ALL, 1854-55.....	7,970	230,817	159,652	775,712	610,413

N.B.—The Expenditure on Repairs is not truly shown, having been omitted or imperfectly
in these Abstracts, which were not technically

different BRANCHES of the Public Service for 1854-55. (Details in Table II.)

Bombay.	Saugor and Nerbudda Territories.	Hyderabad assigned Districts.	Nagpore.	Pegu.	Tenasse- rim and Martaban.	TOTALS.		
						Original Works.	Repairs.	GRAND TOTAL.
£	£	£	£	£	£	£	£	£
80,767	15,605	2,589	1,800	69,371	674	891,621	....	....
39,363	12,511	....	....	360	212	....	132,211	1,023,832
6,815	898	2,313	....	3,555	104	29,150	....	....
1,436	....	....	....	....	8	....	5,053	34,204
3,297	....	....	....	428	....	8,076	....	....
592	....	....	....	....	....	....	1,737	9,813
....	....	....	....	....	....	2,893	....	....
....	30	....	....	....	....	....	309	3,203
3,999	....	907	....	124	195	21,668	....	....
1,659	....	....	....	....	8	....	5,573	27,241
26,805	....	1,568	....	....	....	357,302	....	....
....	....	1,271	....	....	....	....	186,931	543,333
4,908	....	....	....	5,404	....	18,812	....	....
1,840	....	....	....	....	18	....	2,858	21,670
2,156	....	....	....	....	....	29,550	....	29,550
128,750	16,504	7,378	1,800	78,884	974	1,359,075	....	....
44,892	12,541	1,271	....	360	246	....	333,775	....
173,642	29,046	8,650	1,800	79,244	1,221	....	....	1,692,850
53,651	945	....	....	97,891	7,042	488,685	....	....
21,068	....	....	....	....	946	....	78,181	....
74,719	945	....	....	97,891	7,988	....	....	566,867
182,401	17,449	7,378	1,800	176,775	8,016	1,847,760	....	....
65,960	12,541	1,271	....	360	1,193	....	411,956	....
248,362	29,991	8,650	1,800	177,135	9,209	....	....	2,259,717

given in several of the Reports. Items have in many cases been transferred to Repairs so returned by the Departmental Offices.

With respect to the preceding Table (I,) it may be pointed out, that the expenditure on Military Works bears to the whole expenditure in the different provinces the following proportions :—

In Bengal	nearly 10½ per cent.
„ North-Western Provinces.....	„ 13 „
„ Punjab	„ 37 „
„ Madras	„ 7½ „
„ Bombay	„ 30 „
„ Saugor and Nerbudda	„ 32 „
„ Pegu	„ 55 „
„ Tenasserim.....	„ 87 „

The expenditure in the Punjab, in 1854-55, has been equal to the sum of the expenditure in Bengal, North-Western Provinces, Bombay, and Pegu.

The expenditure on *Original Works* in the Punjab nearly equals the aggregate of that in Madras, Bombay, and the North-Western Provinces.

That in Original Works in Madras nearly equals the aggregate of the same expenditure in all the provinces in more particular relation to the Supreme Government, except the Punjab, viz., Bengal, North-Western Provinces, Pegu, Tenasserim, and the Saugor-Nerbudda Territories, a fact scarcely consistent with the local partialities sometimes alleged against the distribution of sanctions by the Supreme Government.

Whilst Madras has spent 270,000*l.* in the construction of Trunk and District Roads, Bengal has spent only 60,000*l.*, and out of the Madras expenditure a sum of 18,000*l.* (on the Akyab Road) might almost be transferred to the heading of Military Works, whilst two or three items consume all the remainder.

The North-Western Provinces show but 3,800*l.* spent on the construction of roads.

In the last case this would *probably* have been considerably increased, had returns of the expenditure from local funds been received.

An interesting subject of inquiry would have been the cost of road maintenance all over India; but the returns of repairs are defective, and other data are wanting.

The next Table (II,) exhibits, in greater detail, the Expenditure set forth in Table I.

TABLE II.—*Tabular View of EXPENDITURE on PUBLIC WORKS by the different INDIAN ADMINISTRATIONS in 1854-55, in more detailed classification of objects than given in Table I.*

BRANCH, "PUBLIC." (1, 2, 3, £1,023,832.)

(1.) ROADS AND COMMUNICATIONS.

Provinces, 1854-5.	Trunk or Main Roads.	Secondary Roads.	Ferries and sundry Bridges.	Dák Bunga- lows, &c.	Navgbl. Canals and Rivers.	Repairs.	TOTAL.
	£	£	£	£	£	£	£
Government of India	7,970	....	....	....	....	....	7,970
Bengal	59,473	3,019	3,959	493	2,001	26,964	95,912
North-Westn. Provinces	3,702	164	....	352	....	7,885	12,105
Punjaub	272,583	51,577	9,282	98	....	633	334,175
Madras	40,228	230,739	1,313	336	5,671	32,920	311,210
Bombay	46,380	20,426	426	2,850	....	31,780	101,865
Saugor and Nerbudda...	14,416	....	....	....	....	12,164	26,581
Hyderabad .....	....	2,486	....	....	....	....	2,486
Nagpore .....	....	684	....	1,116	....	....	1,800
Pegu	32,724	....	....	....	....	....	32,724
Tenasserim .....	....	674	....	....	....	212	886
Total	477,480	309,772	14,982	5,248	7,673	112,561	927,717

(2.) GENERAL.

Provinces, 1854-5.	Post Offices.	Hospitals and Dis- pensaries.	City Improve- ments.	Sea Defences.	Miscel- laneous.	Repairs.	TOTAL.
	£	£	£	£	£	£	£
Bengal.....	858	521	....	....	2,792	7,376	11,548
North-Westn. Provinces	1,056	....	....	....	10,185	483	11,724
Punjaub	1,025	70	448	....	....	....	1,543
Madras .....	....	106	....	3,286	180	1,000	4,572
Bombay	163	630	1,696	....	2,531	5,363	10,385
Saugor and Nerbudda...	924	....	....	....	....	....	924
Hyderabad	102	....	....	....	....	....	102
Pegu.....	....	....	35,495	....	1,054	360	36,910
Total	4,130	1,328	37,641	3,286	16,743	14,583	77,713

(3.) POLITICAL.

Provinces, 1854-5.	Govt. Houses & Offices.	Miscel- laneous.	Repairs.	TOTAL Political	Police and Gaols.	Court Houses, &c.	Repairs.	TOTAL Judicial.
	£	£	£	£	£	£	£	£
Bengal	2,685	....	2,000	4,685	5,761	4,615	2,047	12,424
North-Westn: Prov.	....	....	....	....	115	1,026	61	1,203
Punjaub	4,501	....	....	4,501	1,150	....	....	1,150
Madras	125	....	500	625	1,696	1,098	1,500	4,294
Bombay	5,661	....	2,219	7,880	4,866	1,948	1,436	8,251
Saugor and Nerbudda	264	....	347	611	12	886	....	898
Hyderabad .....	....	....	....	....	2,313	....	....	2,313
Pegu.....	....	96	....	96	3,555	....	....	3,555
Tenasserim .....	....	....	....	....	30	74	8	113
Total	13,238	96	5,066	18,401	19,501	9,649	5,053	34,204

TABLE II.—*Continued.*

Provinces, 1854-5.	(5.) ECCLESIASTICAL.			TOTAL Ecclesi- astical.	(6.) EDUCATIONAL.		
	Churches.	Burying Grounds.	Repairs.		Construction of Schools and Colleges, &c.	Repairs.	TOTAL Educational.
Bengal	£ 414	£ 133	£ 1,093	£ 1,640	£ 242	£ 263	£ 505
North-Western Prov.	61	185	50	297	2,581	16	2,598
Punjaub	2,605	426	....	3,032	....	....	....
Madras	448	76	....	524	68	....	68
Bombay	3,025	271	592	3,890	....	....	....
Pegu	165	262	....	428	....	....	....
Tenasserim .....	....	....	....	....	....	....	....
Saugor and Nerbudda	....	....	....	....	30	....	30
Total	6,720	1,356	1,737	9,813	2,893	309	3,203

Provinces, 1854-5.	(7.) REVENUE—GENERAL.				(8.) REV.—IRRIGATION.			
	Custom and Toll Houses.	Salt and Opium.	Other Revenue Build- ings.	Repairs.	TOTAL Revenue.	Construc- tion.	Repairs.	TOTAL.
Bengal	£ 476	£ 6,874	£ 1,406	£ 2,815	£ 11,571	£ 488	£ 42,380	£ 42,868
No.-Wes. Prov.	1,767	952	747	89	3,556	88,307	18,938	107,246
Punjaub .....	....	1,396	....	....	1,396	135,560	3,441	139,001
Madras	62	598	2,160	1,000	3,821	104,572	120,000	224,572
Bombay	509	215	3,275	1,659	5,659	26,805	....	26,805
Saugor and Nerb.	....	....	....	....	....	....	....	....
Hyderabad .....	....	....	907	....	907	1,568	1,271	2,840
Pegu.....	....	....	124	....	124	....	....	....
Tenasserim .....	....	....	195	8	204	....	....	....
Total.....	2,814	10,036	8,816	5,573	27,241	357,302	186,031	543,333

Provinces, 1854-5.	(9.) MARINE.			(10.) RAILWAY.		
	Construc- tions.	Repairs.	TOTAL.	Land.	Control, &c.	TOTAL.
Bengal.....	£ 1,958	£	£ 1,958	£ 13,911	£ 6,440	£ 20,352
Madras.....	6,541	1,000	7,541	4,262	2,779	7,041
Bombay	4,908	1,840	6,748	69	2,087	2,156
Pegu.....	5,404	....	5,404	....	....	....
Tenasserim .....	....	18	18	....	....	....
Total.....	18,812	2,858	21,670	18,242	11,307	29,550

TABLE II.—*Continued.*
(11.) MILITARY WORKS.

Provinces, 1854-5.	Defensive Works and Ordnance Buildings.	Accommo- dation for Troops.	Stud and Commissari- at Buildings.	Canton- ment Roads and Clearance.	Miscel- laneous.	Repairs.	TOTAL. Military.
Bengal	£ 1,342	£ 13,603	£ 132	£ 724	£ 2,048	£ 9,497	£ 27,350
North-Western Prov.	281	15,295	1,317	437	....	3,588	20,920
Punjab	62,195	168,147	5,526	15,874	6,086	33,081	290,911
Madras	431	35,709	....	....	....	10,000	46,141
Bombay	21,560	25,486	872	154	5,577	21,068	74,719
Saugor and Nerbudda	....	945	....	....	....	....	945
Hyderabad	Included	under	Madras.	....	....	....	....
Nagpore							
Pegu	5,062	76,125	1,797	13,400	1,506	....	97,891
Tenasserim	1,756	5,055	147	....	82	946	7,988
Total	92,630	340,368	9,793	30,590	15,301	78,181	566,867

TABLE III.—WHOLE OF INDIA : *Abstract of Classified Expenditure from the foregoing Tables, 1854-5.*

Trunk and Main Roads....	£ 477,480	£	Brought forward ..	£	£ 1,071,051
Secondary Roads	309,772		Customs and Tolls	2,814	
Ferries and sundry Bridges	14,982		Salt and Opium.....	10,026	
Dâk Bungalows.....	5,248		Other Revenue Buildings	8,816	
Navgbl. Canals and Rivers	7,673		Repairs	5,573	
Repairs	112,561	927,717	Canals, Tanks, and Em- bankments	357,302	27,241
Post Offices	4,130		Repairs	186,031	
Hospitals, &c.	1,328		Marine Works	18,812	543,333
City Improvements	37,641		Repairs	2,858	
Sea Defences.....	3,286		Land, &c., for Railway	18,242	
Miscellaneous	16,743		Superintendence of Land	11,307	
Repairs	14,583	77,713	Transfer and Control		21,670
Govt. Houses and Offices	13,238		of Railway		
Miscellaneous	96		Total Civil Works....	....	1,692,845
Repairs	5,066	18,401	Defensive Works and Ordnance Buildings..)	92,630	
Police and Gaols	19,501		Accommodatn. for Troops	340,368	
Court Houses	9,649		Commissariat Buildings..	9,793	
Repairs	5,053	34,204	Cantonment formatn., &c.	30,590	
Churches	6,720		Miscellaneous	15,301	
Burial Grounds.....	1,356		Repairs	78,181	
Repairs	1,737	9,813	Total Military Works	....	566,867
Schools and Colleges	2,893		Grand Total, Expen- diture.....	....	2,259,712
Repairs	309	3,203			
Carried forward....	....	1,071,051			

TABLE IV.—*Statistics of Expenditure on several of the Greatest Works still in Progress in India, 1857.*

Names of Works.	Com-menced.	ESTIMATE.	Amount Expended in previous Years.	Amount Expended in 1854-55.	Total Expenditure.
	Year	£	£	£	£
(1.) Grand Trunk Road, Calcutta to Lahore	1831-32	....	721,461 ^a	58,663 ^b	780,124
(2.) Lahore and Peshawur Road	1852	514,066	260,769	224,477	485,246
(3.) Great Deccan Road ...	1833-34	....	44,654	2,407	47,061
(4.) Patna and Gya Road ...	1854-55	100,000	....	14,955	14,955
(5.) Dacca and Arracan Road	1853-54	....	11,125 ^c	18,088 ^c	29,213
(6.) Meaday, Prome, and Toungoop Road.....	1853-54	102,350	8,142	31,245	39,387
(7.) Ganges Canal	1843	1,421,305	1,253,070	71,689	1,324,759
(8.) Baree Doab Canal (Punjab)	1851-52	528,790	171,478	117,939	289,417
(9.) System of Irrigation and Navigation in connexion with the Godavery Anicut (Madras) .....	....	....	....	....	....
(10.) Kishna Anicut project (Madras) .....	....	155,000	75,000	23,333	98,333
(11.) Supply Channel to the Eastern Narra (Scinde)....	....	60,452	7,433	6,710	14,144

(1.) This total is imperfect. The amount *a* includes Expenditure on Establishment, Salaries, and Contingencies; *b* does not include the whole of such charges; and the sixth Division has made no Return of Expenditure for 1854-55.

(2.) The original rough estimate for a road “to meet the immediate military wants of the country” was only 155,000*l.* The estimate here taken is that given in Colonel Napier’s published Road Report dated September 1854, as a rough calculation of cost of the work as it is being done. It does not include Establishment or Metalling west of the Jhelum.

(3.) Does not include Salaries of Superintending Establishment. The work was principally executed in 1833-34, and its completion, as a first class road, has only lately been undertaken.

(4.) 100,000*l.* is a rough estimate only. A first-class road.

(5.) *c* There is a doubt about these items, from the absence of report from one division.

(6.) The road across the Yoma Mountains from the Irrawadie to the sea.

(7.) This includes 17,128*l.* spent on Distributary Channels, which is considered an advance recoverable from the cultivators, and is not provided for in the estimate. The Ganges Canal was not fairly started till 1845.

(8.) This estimate was drawn up by Lieutenant Dyas on the basis of Colonel Caulley’s G. C. rates. A revised estimate is in preparation, which will amount to about 800,000*l.*

(9.) It is to be regretted that the means of drawing up a Statement of Expenditure on this great system of works does not yet exist in this office.

The preceding Tables (I—IV,) have exhibited the Expenditure on Public Works in the year 1854-5—the two following Tables (V and VI,) contain an outline of the corresponding Expenditure in the anterior year 1853-4.

Table VIII relates to the important and interesting Irrigation outlays in Madras 1836-49.

TABLE V.
WHOLE OF INDIA: EXPENDITURE ON PUBLIC WORKS, 1853-54.

CLASSES OF WORKS. 1853-4.	Salaries, Establish- ments, and Miscellaneous Expenses.	Repairs.	New Works.	Land Rented and Purchased.	TOTAL.
					£
Churches, Public Offices, Jails, and Miscellaneous Buildings and Works	181,239	53,712	54,438	3,141	292,533
Embankments .....	...	57,095	....	....	57,095
Roads and Bridges .....	....	182,855	397,663	1,254	581,773
Lighthouses, Dockyards, and Harbours	Included in the above.	4,593	11,211	1,100	16,904
Inland Navigation.....	...	2,820	4,267	..	7,088
Irrigation Works	96,710	246,777	387,382	7,145	738,015
Railroads. { Charges for Government Officers and for Lands supplied to Private Com- panies working under Government Guarantee }	9,758	....	....	16,450	26,208
Electric Telegraph	3,818	....	101,973	....	105,791
Military	123,736	95,634	337,009	13,997	570,378
Unclassified .....	....	....	216,948	....	216,948
Total	415,264	643,491	1,510,895	43,088	2,612,739

In the next Table (VI,) a further detail is given as regards 1853-4.

TABLE VI.

*DETAILS of the Principal Items of EXPENDITURE on NEW WORKS, 1853-4
and 1854-5.*

Presidency or Province.	Names of the Works.	Expenditure, as per Accounts, of 1853-54.	Estimated for 1854-55.
	<i>Churches, Public Offices, Jails, and Miscellaneous Buildings and Works.</i>	£	£
	The new Works included in the first item of the foregoing Statement are, in very few instances, specified in the Financial Statements, and are very numerous, and for the most part not of any large amount.		
	<i>Embankments.</i>		
	The Expenditure on Embankments includes renewals and new Works as well as repairs; but the whole Expenditure is entered under the single head "Poolbundee."		
	<i>Roads and Bridges.</i>		
Bengal.	New Works on the Grand Trunk Road, namely, the Bridges over the Mugra and Sautgong Khals, the Leelajim, Morhur, Boorya, Bootana, and Barakur Rivers; the Viaduct over the Doorgowtee Flood; and the Causeway in the bed of the Soane.....	11,782	
	The Patna and Gya Road .....	....	....
	The Dacca and Arracan Road	29,213	82,200
	The Tongoop Road	8,142	....
N.W.P.	The Hindostan and Thibet Road	5,640	....
	New Works on the Grand Trunk Road in the North-West Provinces	41,670	2,600
	" Great Deccan Road		
	" Agra and Bombay Road		
Punjab.	Grand Trunk Road from Kurnaul to Lahore.....		11,957
	Lahore and Peshawur Road	202,609	179,582
	Other Roads in the Peshawur Province		40,819
Madras.	Trunk Roads in the Madras Presidency	29,514	41,075
	Constructing Roads in Bellary to provide for the Poor during the Scarcity.....	24,508	10,716
	Ditto Ditto in Nellore	5,400	7,057
Bombay.	District Roads	25,335	145,054
	Poona and Sholapoor Road .....	....	11,122
	Other Roads in Bombay and Scinde	{ Not separated from Repairs.	58,962
Bengal and Pegu.	" Bengal and Pegu	13,846	4,109
	Total.....	397,663	618,656

TABLE VII.—Statement of RECEIPTS and DISBURSEMENTS by the EAST INDIA COMPANY in ENGLAND AND INDIA, on account of the unmentioned Railways, to date of latest advices received, 1849-57.

RAILWAY COMPANY.	Estimated Outlay required to complete the several Lines sanctioned.	Amount of Capital at present authorized to be raised.	Paid by Railway Companies.	Amount Expended in the Re-issue by Treasuries.		
				Into Treasury in England, to 31 Dec., 1857.	Total Sum paid up in India, to 31 Oct., 1857, by Companies.	In England, to 31 Dec., 1857.
East Indian	£ 12,731,000	£ 8,731,000	£ 7,386,479 to 31 Dec., 1857	£ 225,835	£ 7,612,314 to 31 Dec., 1857.	£ 3,472,951
Calcutta to Delhi, 1,100 miles. Mirzapore to Jubbulpore, 300 miles.						£ 6,854,849
Great Indian Peninsula	10,000,000	6,000,000 Divis 333,300	3,022,957 333,300	325,981	3,682,238	1,320,033
To Callian, 33 miles. To Jubbulpore, 818 miles. To Krishna, 357 miles.						1,041,082
Madras	6,000,000	4,000,000	2,294,235	nil.	2,294,235	1,019,194
To Bayapore, 430 miles. Do. to Krishna River, 310 miles.						1,047,919 to 31 Aug., 1857.
Sindia	1,000,000	1,000,000	360,360	11,550	371,910	208,840
Kurrachee to Kosru, 120 miles. Projected Multan to Lahore, 230 miles. 330 miles.						32,736 including Punjab Survey, 6,350L
Bombay, Baroda, &c.	2,000,000	1,750,000	461,344	11,089	472,433	255,402
						94,891
Eastern Bengal	1,000,000	1,000,000	nil.	nil.	nil.	356,293
130 to Koosru, near Pusah.						nil.
Total	32,731,000	22,814,000	13,858,668	574,455	14,433,123	

Cost per Mile of such parts as have been Completed.

East Indian.—Calcutta to Raneeunge 121 miles, about 12,000/- per mile. Madras to Arcot 65 miles, about 5,050/- per mile. Bombay—not yet shown. The East Indian is earning about 7 per cent. The receipts from the third class passengers are four times greater than those of the first and second classes combined. In the course of 1858-59 large portions of the Lines will be opened.

The Electric Telegraphs connect the three Presidencies, and extend over more than 3,000 miles, and extensions are going on to about the same extent. The cost has been about 50/- per mile. Although the charges are very moderate, the revenue in the first year's working exceeded the expenses, and they are increasing.

[June,

TABLE VIII.
Special and other Works of Irrigation Performed

DISTRICT.	1	2	3 Name of Work and Year in which the First Expenditure (col. 4,) was incurred.	Amount of First Expendi- ture.	Cultivation and Revenue before Influence of Work felt.		Highest Cultivation and Revenue since Influence of Work felt.	
					Cultivation.	Revenue.	Cultivation.	Revenue.
					£	Acres.	£	Acres.
Rajahmundry	1	Thoolia Bagah, 1846	820	3,824	1,765	8,116	3,242	
do.	2	Samulcottah Channel, 1846	1,347	3,317	1,782	6,339	3,969	
		Boopiah Calwah, '39-'41....						
		Gosta Nuddee						
do.	3	Apparow Calwah	1,925	30,336	10,569	46,982	14,906	
		Woosalamurro ditto, and other minor Channels connected with these four						
Masulipatam	4	Pulleiroo Channel, 1837	1,371	2,225	951	15,820	6,991	
do.	5	Boodemair Channel, '38-'39	809	not reprtd.	1,751	3,740	2,922	
do.	6	Apparow Channel, '42-'45..	875	"	4,431	not reprtd.	10,322	
Guntoor	7	Toongabuddra Channel, } '41-'46	3,421	"	1,377	"	5,443	
do.	8	Coochenapoody Tank sup- } plying Channel, 1847	36	"	58	"	256	
do.	9	Vellatoor Channel from the } Krishna, '38-'39	708	"	106	"	1,505	
do.	10	Moonunghee Channel from } the Krishna	1,185	"	....	....	....
do.	11	Ivany Tank, '39-'40	380	"	nil.	not reprtd.	130	
Nellore	12	Veroor River — Channel, } 1847	175	791	483	1,244	742	
Cuddapah	13	Tungatoor Dyke, '46-'47	395	249	222	387	344	
Bellary	14	Numbelgherry Tank, 1844....	320	not reprtd.	5	not reprtd.	71	
Chingleput	15	Spring Channel for the } supply of Poosevaukum } Tank, '47-'48	160	192	69	316	108	
do.	16	Re-opening a River Channel } for the supply of the Mana- } paukum Tank, '47-'48 ..	149	87	55	161	133	
do.	17	Porel Tank supplying } Channel, 1839	1,068	1,256	449	2,004	893	
South Arcot....	18	Lower Anicut and dependent works, '36-'37	7,423	18,934	13,615	34,978	30,375	
do.	19	Vellár Anicut, '46-'48	8,291	5,958	3,762	9,158	6,343	
do.	20	Rágavien's Channel, '47-'48	1,360	2,668	1,920	3,590	2,531	
Salem	21	Extending Mahdévy Tank, } '44-'46	180	71	55	120	89	
Tanjore	22	Upper Coleroon Anicut, } 1836	8,340	522,202	270,073	583,464	325,887	
do.	23	South Rajah Voikal, 1837....	6,075	24,456	11,438	29,919	13,629	

in the MADRAS PRESIDENCY, from 1836 to 1849.

9	10	11	12	13	14	15	16	17	18	19	
Increase and Decrease of Revenue since Influence of Work felt.						Repairs.		Average Annual		Average Annual Per Centages on First Cost, viz., Increase.	Gross Increase at end of Period.
Total Increase.		Total Decrease.		Net Increase.	Cost of Repairs.	Net Increase after deducting Repairs.	Net Increase.	Net Decrease.	Pr. ct. pr. ann.	£	
Yrs.	£	Yrs.	£	£	£	£	£	£	Pr. ct. pr. ann.	£	
5	4,568	5	....	4,568	2,764	1,803	360	...	44	983
5	6,644	5	....	6,644	1,420	5,224	1,044	....	77 $\frac{9}{16}$	3,877
8	21,667	2	2,692	18,975	1,362	17,612	1,761	....	91 $\frac{7}{16}$	15,687
12	39,835	2	1,194	38,641	2,463	36,177	2,584	....	188	34,806
6	5,076	6	4,496	580	267	312	26	....	3 $\frac{1}{8}$	....
9	25,041	1	1,754	23,286	577	22,709	2,271	....	259 $\frac{5}{8}$	21,834
7	15,382	....	....	15,382	3,970	11,411	1,630	....	47 $\frac{5}{8}$	7,989
3	495	1	22	472	183	288	72	....	197 $\frac{1}{4}$	252
11	9,276	2	159	9,116	940	8,176	629	....	88 $\frac{3}{4}$	7,467
....	....	....	....	....	....	....	59	....	....	....
12	633	....	....	633	667	....	....	2	....	....
4	957	....	....	957	33	924	231	....	132	748
5	503	....	....	503	31	471	94	....	24	76
7	430	....	....	430	....	430	61	....	19	110
3	63	....	13	49	....	49	16	....	10	....
3	206	....	....	206	42	164	52	....	35	14
13	4,311	....	....	4,311	503	3,807	292	....	27 $\frac{1}{4}$	2,738
14	142,297	....	....	142,297	3,997	138,299	9,878	....	133 $\frac{1}{16}$	130,876
5	9,265	....	....	9,265	803	8,461	1,692	....	20 $\frac{3}{8}$	169
4	1,507	....	468	1,039	28	1,010	252	....	18 $\frac{9}{16}$	....
5	117	....	....	117	3	114	22	....	12 $\frac{5}{8}$	....
12	240,351	3	32,060	208,291	27,238	181,052	12,070	....	144 $\frac{11}{16}$	172,712
14	18,915	....	....	18,915	6,612	12,303	878	....	14 $\frac{7}{16}$	6,227

[June,

TABLE VIII.-
Special and other Works of Irrigation Performed

DISTRICT.	1 2	Name of Work and Year in which the First Expenditure (col. 4,) was incurred.	Amount of First Expendi- ture.	Cultivation and Revenue <i>before</i> Influence of Work felt.		Highest Cultivation and Revenue <i>since</i> Influence of Work felt.	
				Cultivation.	Revenue.	Cultivation.	Revenue.
Trichinopoly	24	New Iyen Voikal, 1836.....	£ 1,132	Acres. 14,458	£ 10,238	Acres. 16,031	£ 10,540
do.	25	Ruttnagoody Anicut and Nuttud Nullah, '47-'48	1,094	2,299	677	2,892	837
Coimbatore	26	Extension of Poolavalungul Channel, '43-'46	248	140	67	379	137
do.	27	Nunjah Pogalore Channel Improvement, '36-'38	488	1,180	589	1,509	760
do.	28	Wall in front of Calingroyen Anicut, and widening Vunnandoray Aque- duct, '37-'39.....	453	6,649	8,117	7,140	8,727
do.	29	Pillyoor, Tandinary, and Sanapareddy Auxiliary Tanks, and Coyenbully Channel, 1838	651	1,707	803	2,219	1,520
Madura	30	Under Sluice and Wall to Chittanai across Vigay River, '39-'40	246	1,199	471	1,645	982
Tinnevelly	31	Adachany Channel, '40-'44	655	250	125	509	332
do.	32	Valathacolum Tank, 1846 ..	145	16	5	106	53
do.	33	Teeravangadanadapoorum Tank, 1847	64	156	108	250	266
do.	34	Autoor Tank Improve- ments, '39-'40	324	....	935	not reprtd.	1,594
do.	35	Maranthy New Channel, '37-'41	1,040	265	87	,"	292
do.	36	13 Works, 1847.....	743	1,575	1,028	2,288	1,357
			54,111	646,461	348,201	781,306	458,244
Tanjore	37	Widening Mooliar, 1844 ..	709	8,912	3,538	1,0345	4,306
do.	38	Hurrychundranuddy Anicut, and Talnoyer Cota- gum, 1842	456	3,094	1,307	4,491	2,641
do.	39	New Nullar connected there- with, '45-'46.....	521	6,419	2,571	6,812	2,986
do.	40	Improvement of Mercal- kurrai River, '46-'49.....	860	15,927	5,646	18,258	6,323

*Continued.**in the MADRAS PRESIDENCY, from 1836 to 1849.*

9	10	11	12	13	14	15	16	17	18	19
Increase and Decrease of Revenue since Influence of Work felt.				Repairs.		Average Annual		Average Annual Per Centages on First Cost, viz., Increase.	Gross Increase at end of Period.	
Total Increase.		Total Decrease.		Net Increase.	Cost of Repairs.	Net Increase after deducting Repairs.	Net Increase.	Net Decrease.	Pr. ct. pr. ann.	£
Yrs.	£	Yrs.	£	£	£	£	£	£	Pr. ct. pr. ann.	£
14	1,393	....	1,911	....	1,283	....	128	....	....	....
3	439	....	....	439	315	124	41	....	3 $\frac{3}{4}$	....
8	493	....	....	493	145	348	43	....	17 $\frac{1}{2}$	99
13	1,768	....	....	1,768	320	1,448	111	....	22 $\frac{3}{4}$	959
13	3,591	....	....	3,591	1,499	2,091	160	....	35 $\frac{1}{2}$	1,638
13	7,620	....	....	7,620	322	7,298	561	....	86 $\frac{2}{15}$	6,646
13	3,486	....	....	3,486	611	2,875	221	....	89 $\frac{5}{8}$	2,628
7	1,134	....	....	1,134	96	1,037	148	....	22 $\frac{5}{8}$	382
5	179	....	....	179	6	172	34	....	23 $\frac{3}{4}$	27
4	419	....	....	419	....	419	104	....	163	354
11	4,118	....	65	4,053	685	3,367	306	....	94 $\frac{3}{8}$	3,043
12	1,336	2	12	1,324	72	1,252	89	....	8 $\frac{9}{15}$	212
2	882	2	642	240	5	235	58	....	7 $\frac{7}{8}$	....
	574,412		45,494	529,435	59,276	471,475	37,805	190		422,567
					Deduct	Decrease	190		Ded. Dec.	7,037
					Net	Increase	37,614		Avrg. ann. per cent. on 1st cost	415,529*
7	4,403	....	....	4,403	119	4,283	611	....	86 $\frac{1}{4}$	3,573
8	6,859	....	....	6,859	18	6,841	855	....	187 $\frac{1}{4}$	6,384
7	2,178	....	....	2,178	18	2,160	308	....	59 $\frac{1}{4}$	1,639
4	1,011	....	92	918	219	699	174	....	20 $\frac{5}{15}$	161

* Gross profit on all the works.

In the preceding Statement (VIII,) the prime cost of each work (or the cost to the time at which its results were fairly developed) is alone entered in col. 4, and the subsequent expenditure in col. 14.

This method is preferable to a former one of adding the whole expenditure together, and calculating the per centage of the results thereupon, it being evident that, as the expenditure for repairs and improvements is (like the revenue) spread over a series of years, the difference between the two, divided by the number of years, constitutes the real annual result, to be reckoned as a per-centage upon the prime cost.

It follows from the adoption of this method, and from the omission of some works of an ordinary character, and not admitting of the exhibition of per-centage results, or, as in Tanjore, merged in others, that the total of col. 4 is much less than that of the same column in a former Statement.

The total amount in col. 14 is probably above the truth; as in some instances repairs of old works, or parts of works, have been mixed with those properly belonging to the improvement.

In No. 1, col. 14, shows the repairs and improvements, exclusive of those undertaken for navigation.

As No. 10 was never completed, and consequently produced nothing, the loss upon the expenditure is reckoned at 5 per cent., the usual interest of money.

The expenditure and results of Nos. 37 to 40 are entered only to illustrate the advantages derived from irrigation improvements in the Tritrapoondy talook of Tanjore, which has undergone so beneficial a change therefrom, and are not included in the general totals, being already included under the head of the Upper Coleroon Anicut, which influences them all.

The results of the Anicut are thus ascertained :—

The prime cost is first entered in col. 4.

The average annual expenditure for the whole of the irrigation works in the district (exclusive of those under the Lower Anicut, and exclusive of repairs rendered necessary by the Anicut in Trichinopoly) for the period *after*, and the same for ten *before*, the construction of the Anicut being then ascertained, and the latter average being deducted from the former, the difference is multiplied by the number of years composing the period in question, that is by 15 (from 1836 to 1850), and the product deducted from the aggregate increase of revenue during the same period, the remainder being the net profit, which is again divided by 15, and the quotient is the average annual profit on the prime cost.

This is the only practical way of showing the true value of the Anicut, since, were the different improvements subsequent to that work considered as so many separate bases of calculation, the only effect would be extreme complication, without any more satisfactory result. By the method actually followed, the entire expenditure is brought to account, but all as subsidiary (which it really was) to the Upper Anicut.

The results in this case are shown at a less amount than the fair reality, owing to the comparison of expenditure having included ten years before the construction of the Anicut. But, as the average revenue in col. 6 is reckoned from Fusly $\frac{1240}{1830-31}$, the first in which the nunjah cultivation and revenue under the *rivers* are separately shown, it would have been more proper, strictly speaking, to reckon the average expenditure before the construction of the Anicut from that, and not, as it has been, from an earlier year; since the calculation of the revenue, had it been practicable, from the same earlier year would have altered the average in col. 6. Had this course been followed, the gain from the Anicut would, as above said, have appeared much greater; for the expenditure from $\frac{1240}{1830-31}$ to $\frac{1245}{1835-36}$ averaged 10,416/-.

instead of 7,771*l.*, the average (from $\frac{1230}{1826-27}$ to $\frac{1245}{1835-36}$) actually taken, the former average being, in fact, greater than that of the whole outlay for repairs of any new works (including great improvements to the Anicut, the Cavery Dam, the Coiladdy Calingulah, the Cavery and Vennár Dam [in part], and other considerable improvements, but excluding the Lower Anicut repairs charged under Nos. 18 and 23) subsequent to the construction of the Anicut, which was 9,587*l.*

If, therefore, the six years' average from $\frac{1240}{1830-31}$ to $\frac{1245}{1835-36}$ were taken as the basis, the difference between it and the average since the construction of the Anicut, that is, 10,416*l.* — 9,587*l.* = 829*l.* which $\times 15 = 12,435*l.*$ should be *added* to the increase of revenue in col. 10, and the total gain would then be 220,726*l.*, which divided by 15, would give the annual gain at 14,715*l.*, or 176 *$\frac{3}{8}$* per cent. on the prime cost. If it were *not* added, the average annual gain would be 13,886*l.*, or 166 *$\frac{1}{2}$* per cent. on the prime cost.

It is, indeed, a memorable truth that the condition of things before the Anicut required a greater annual expenditure in imperfect and mostly temporary expedients to preserve the cultivation and revenue than what has since been incurred to bring under cultivation an additional area of 61,262 acres (exclusive of the increase under the South Rajah Voikal), besides greatly increasing the productiveness of the old lands.

The whole of the Tanjore expenditure and revenue under the rivers is entered in Nos. 22 and 23, except a moiety of the repairs of the Lower Anicut entered in No. 18.

The principal irrigation works at Madras are those of the Cole-roon and Cavery Rivers. They are of very early date; but have been greatly extended of late years. Up to 1850, they were capable of watering 716,524 acres; and the increase of revenue has been about 44,000*l.* per annum.

The next great work is the Godaverry Anicut, upon which, up to 1852, 130,000*l.* had been expended; but a further outlay would be required which would raise the cost to 264,000*l.* The absolute *outlay*, however, had been already covered by the increased revenue, and it was calculated that, when completed, it would give 300,000*l.* per annum.

The Krishna Anicut was only commenced in 1853. The estimate is 155,000*l.* to irrigate 280,000 to 350,000 acres of land through 290 miles of channels.

In 1854, an expenditure of 86,611*l.* was sanctioned for the construction of an Anicut in the Palar River, in North Arcot, the expected revenue from which is 16,623*l.*

Special and other works of irrigation are shown in the accompanying table from 1836 to 1849.

The Court is also disposed to encourage private companies to undertake irrigation works by guaranteeing interest on the footing of railways; and orders were sent out in September last to the Indian Governments to frame rules under which companies might construct irrigation works.

In a tropical country like India, where for eight months in the

year very few showers of rain fall, and where the monsoons are irregular and uncertain in their supply of water, the importance of works to promote irrigation can scarcely be too highly estimated. Nevertheless it must be borne in mind, that the lands producing the chief grains upon which the great mass of the population lives could not bear a water-tax, which would enhance the price of the cerealia; and, consequently, there is a limit to the politic and benevolent objects of Government in promoting works of irrigation. It is quite a mistake to suppose that the bulk of the population in India lives upon rice, which, from requiring a water supply, has its cost so much enhanced above that of the plentiful panicums and sorghums, that, as a general food, the consumption of rice is only general in the low districts of Bengal, Orissa, Madras, and Malabar. In Central, North-Western, and Northern India, dry grains are the food of the masses.

TABLE IX.

EAST INDIAN RAILWAY.—*First Section from Calcutta to Raneegunge,
121 Miles.—TRAFFIC RETURNS, 1856.*

Goods.	Half Year ended	Passengers.			
		1st Class. No.	2nd Class. No.	3rd Class. No.	TOTAL. No.
Tons. 33,010	1856.—30th June	6,466	23,256	402,599	432,321
44,675	„ —31st Dec.	6,639	25,877	432,605	463,121
77,685		13,105	49,133	835,204	895,442

Note.—In the six months ended 30th June, 1856, the receipts from the Third Class Passenger Traffic were 20,000*l.*, or equal to an average payment per passenger of 11*d.* sterling.

TABLE X.

Expense Incurred on account of the Great TRIGONOMETRICAL SURVEY of India.

Periods.	Area in Square Miles.	Total Cost. <i>£</i>	Cost per Square Mile. <i>£</i>
1800 to 1822.....	No. 165,342	83,537	.505
1822 to 1842.....	56,997	89,892	1.576
1826 to 1849.....	254,704	167,908	.659
Grand Total	477,043	341,278	.715

The following table exhibits the Revenue Survey Charges under the different Governments in India, from the year 1822-23 to 1856-57 :—

TABLE XI.

Revenue Survey Charges.

	£
Bengal, from 1823-24 to 1855-56	612,446
Tenasserim, from 1834-35 to 1855-56.....	35,236
North-West Provinces, from 1822-23 to 1855-56	405,238
,, Khusreh, from 1833-34 to 1838-39	36,737
Punjab, from 1849-50 to 1855-56	70,999
Cis and Trans-Sutledge States, from 1851-52 to 1855,56	11,375
Bombay, from 1818-19 to 1856-57	818,102
Sind, from 1852-53 to 1856-57	18,221
	<hr/>
	2,008,357
£	
Madras, Estimated Survey Charges	384,000
,, Settlement	380,000

